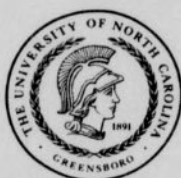


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#### ABSTRACT

CUTTING, DOUGLAS SCOTT. The Effect of Early Manual Communication on Academic Achievement and Acquisition of Linguistic Ideas. (1971)  
Directed by: Dr. Robin W. Pratt. Pp.50.

Deaf children of deaf parents (manual group) were compared with a matched sample of deaf children of hearing parents (oral group) on achievement test scores. The deaf children of deaf parents had early manual communication in the home as a result of such communication with their parents. The deaf children of hearing parents had no systematic communication until entering a school for the deaf at age five. The achievement test scores of the manual group were significantly superior ( $p < .05$ ) to those of the oral group supporting the hypothesis that early communication of a manual nature improves academic achievement in deaf children.

A second study compared these two groups with a hearing sample of the same age and sex on their ability to acquire complex linguistic ideas. Results indicated the hearing Ss were able to abstract linguistic information in a manner similar to that of adult Ss. Of the deaf groups, the manual group showed an ability to abstract on two of the three criteria specified by earlier studies, while the oral group showed less ability, performing similarly to hearing Ss on only one of the criteria. These results were interpreted as supporting previous reports that deaf

children are handicapped in their ability to abstract linguistic ideas due to their language deficiency. Children who have had early manual communication, however, have an improved ability to abstract linguistic ideas as well as improved academic achievement.

EFFECT OF EARLY MANUAL COMMUNICATION ON

ACADEMIC ACHIEVEMENT AND ABILITY

OF LINGUISTIC IDEAS

by

ROBERTA BETH CHURCH

A Thesis Submitted to  
the Faculty of the Graduate School of  
The University of North Carolina at Charlotte  
in Partial Fulfillment  
of the Requirements for the Degree  
Master of Arts

Charlotte

May, 1974

Approved By

*Robert B. Church*

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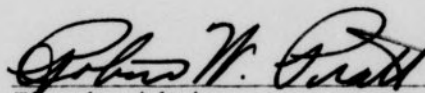
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## Introduction

The relationship between the development of a language system and the growth of cognitive processes has been recognized and explored for centuries. Of particular interest to such study have been the data concerning the deaf--a group of language-handicapped individuals whose lack of systematic communication has yielded valuable information about language, speech, and intellectual development (Furth, 1966).

Specifically, the study of the relationship between deafness and intelligence began around the turn of the century when Pinter (1921) tested thousands of deaf children at 26 schools for the deaf. He developed and employed the Pinter-Non-Language Performance Scale and claimed that "deaf children on the average are two years mentally retarded and five years educationally retarded (Myklebust, 1960, p. 63)."

The study of the intelligence of the deaf continued during the 1930's with the development and use of several new performance scales designed specifically to measure the intellectual capabilities of deaf children. One of the most widely used scales was that devised by Drever and Collins (1939). The test was standardized on deaf children in England, but used extensively in the United States for testing the deaf.

Other performance tests such as the Chicago Non-Verbal Examination (Brown, Stein, & Rohrer, 1947), and the Porteus Maze Test (Zeckle & Van der Kolk, 1939) were developed and administered to deaf children in the United States in an effort to locate and specify the areas of intellectual weakness in the deaf. In general, almost all these scales indicated the deaf were below average on intelligence in comparison to the non-deaf.

More recently, the Wechsler Intelligence Scale for Children (Wechsler, 1949), The Leiter International Performance Scale (Leiter, 1940), and the Nebraska Test of Learning Aptitude in Young Deaf Children (Hiskey, 1955) have been developed to explore the use of individual tests with performance subtests. Most of the earlier tests were group tests which included large verbal sections (Myklebust, 1960). When only the performance scale of a general abilities test was administered or when a performance scale alone was given, deaf children exhibited average intelligence test scores. In a survey of 50 independently conducted investigations of intelligence, Vernon (1969) suggested that the intelligence of deaf children had the same distribution as that of hearing children. Vernon (1969) has stated on the basis of this survey that there is little evidence for a causal relationship between hearing loss and IQ. His conclusion does not include deaf children who have multiple handicaps, or those who have suffered

brain damage in addition to the hearing impairment.

A serious problem in this regard has recently been recognized in that the academic achievement of deaf children fails to reflect their reportedly average intelligence. In an extensive study, McClure (1966) surveyed 93% of the deaf children in the United States who were 16 years or older, comparing their achievement to the educational achievement of hearing children. He found that only 5% reached the hearing equivalent of the tenth grade or higher, as compared to over 73% of normal children. In addition, 60% were at the fifth grade level or lower, and 30% were functionally illiterate.

Wrightstone, Aronow, and Moskowitz (1962) administered the Metropolitan Achievement Tests to 54% of all deaf children between ten and 16 years of age in 73 separate schools for the deaf. They found that 80% of the 16-year-old deaf children scored below fifth grade on reading achievement. Also there seemed to be a plateau of achievement around age ten since they also found the average gain in reading from age ten to age 16 was only 0.8 of a year.

Furthermore, the tendency of the deaf to continue their education after completion of high school is below that of hearing children. Schein and Bushrag (1962) found that 1.7% of deaf persons of college age attended college. This compared with 10% of the hearing population.

Research findings such as those just reported have caused serious concern among educators of the deaf. After reviewing this evidence Vernon (1969) stated, "Thus, despite having the potential to learn, deaf youth are not being given an adequate opportunity to do so (p. 548)." Moores (1970) has suggested that we either continue to produce intellectually normal, but functionally illiterate deaf adults, or reexamine the educational system presently in use in the schools for the deaf.

A possible solution to the problem of this educational lag has been early training in speech and speechreading at the preschool level (Vernon, 1969). Speechreading is the detection of words as they appear at the mouth. Craig (1964) tested 262 deaf children on their reading and speechreading ability in several Eastern United States schools for the deaf. He found the group that had early oral training was not significantly superior in either reading or speechreading to those without any additional oral education.

Phillips (1963) measured academic achievement of a group of deaf children who had early oral training. He found that there were no significant differences in achievement when this group was compared to deaf children who did not have early oral training. Results such as these have indicated that the answer to the problem of achievement in deaf children may be in some area other than early oral



training.

Early Manual Communication and Academic Achievement  
in the Deaf

The disparate results which have been reported in the intelligence testing of the deaf have been due in large part to the type tests employed (Beach, 1969). Scales which included verbal subtests have indicated in general that the deaf are intellectually inferior persons (Myklebust, 1953). Many explanations of this inferiority have been attempted, including neurophysiological and behavioral hypotheses. Most explanations or studies, however, have failed to encompass all deaf persons or even a majority of the deaf. Vernon (1969) stated that this reported inferiority may be explained in part by the deaf person's late and incomplete development of a language system. This retarded linguistic development, rather than inferior mental ability, has been largely responsible for the low scores on verbal intelligence tests, in that these tests provide a measure of the deaf person's linguistic handicap rather than his intelligence (Vernon & Brown, 1964).

Brill (1962) tested the validity of the Performance Scale of the Weschsler Intelligence Scale for Children (WISC), and the Weschsler Adult Intelligence Scale (WAIS) in relation to academic achievement as measured by the Stanford Achievement Test and the Gray-Votaw-Rogers

Achievement Test. He used 105 deaf Ss, divided into four groups: (a) college, consisting of those pupils who had received an academic diploma and had gone to college; (b) academic, consisting of those pupils who had received an academic diploma, but had not continued their formal education; (c) vocational, consisting of those pupils who had received a vocational diploma; and (d) certificate, consisting of those students who had received a certificate of completion. (This last group included students over 16 unable to earn a vocational or educational diploma.) The performance IQ's of all four groups correlated .54 with the mean grade-level of achievement on the Stanford Achievement Test and .55 with the mean grade-level of achievement on the Gray-Votaw-Rogers Achievement Test. Brill stated that this indicates a strong relationship between intelligence as measured by the WISC and WAIS, and academic achievement in deaf persons. The achievement test scores of all four groups were significantly different from each other on both achievement tests. The Academic and College groups were significantly different on intelligence from the Vocational and Certificate groups as measured by a t test.

Other experiments have attempted to classify deaf children on the basis of linguistic abilities in order to isolate what Myklebust (1960), Vernon (1969), and Moores (1970) all agree is the most important factor in the development of academic achievement of deaf children. These

studies have compared the intellectual abilities and academic achievement of two groups of deaf children. One group consisted of deaf children who had deaf parents due to the genetic transmission of deafness which causes 10% of deaf families to have deaf children (Meadow, 1967). This group of deaf children had been exposed to a manual system of language since birth. The nature of the system is fingerspelling, gesturing, or the signing of words through the use of the hands. Thus, the deaf child receives communication input through visual sensation rather than through the auditory channel as does the hearing child. Stuckless and Birch (1966) reported that only five out of 71 deaf parents of deaf children used in research they conducted did not use the system of signs with their deaf child. The comparison group in these studies consisted of deaf children of hearing parents who have had no systematic method of communication until they entered deaf schools around the age of five.

The primary reason most deaf children have not been exposed to manual communication is a feeling among many educators of the deaf that teaching a deaf child manual communication impedes the oral skills necessary for the child to enter a hearing environment, vocationally or socially. In addition, they often warn parents not to use a signing system with their children since schools for the deaf often punish or restrict children for fingerspelling

or signing, insisting that they rely on speech and lipreading in and out of class (Furth, 1966). Without the oral skills of speech and speechreading, an approximation of the language system of the hearing, the logical assumption made by some influential to the educational system of the deaf, is that the deaf child has lower academic achievement, poorer communicative competence, and less ability to abstract linguistic ideas in reading (Myklebust, 1966).

Stuckless and Birch (1966) used 105 deaf children of deaf parents (manual group) and 337 deaf children of hearing parents (oral group), matching the two groups on the variables of age, sex, age upon entrance to the school, severity of hearing impairment, and intelligence test scores. They found no significant differences in speech intelligibility nor in the sociability ratings given by teachers and counselors. They did find significance in reading scores, speechreading scores, and on written language scores. In each area the manual group scored significantly higher than the oral group.

Meadow (1967) matched 56 deaf children of deaf parents with 56 deaf children of hearing parents on the basis of age, sex, degree of hearing impairment, family size, and father's occupation. Before matching was attempted, the pool of deaf children with hearing parents was reduced considerably by elimination of children if they had the following characteristics: (a) deaf siblings; (b) racial or

ethnic minority group membership; (c) secondary handicap (e.g., physical disability in addition to deafness which interfered with functioning); (d) deafened after the age of two years; (e) deafness that resulted from maternal rubella, Rh incompatibility, or anoxia. Comparisons were made in the areas of academic achievement, communicative competence, and sociability. Her results supported the hypothesis that children in the manual group are superior in academic achievement. The manual group was 2.1 years superior in reading ability, 1.25 years superior in arithmetic ability, and 1.28 years superior in overall achievement. All three of these measurements were significant as determined by a t test performed on 31, 32, and 31 matched pairs respectively. In addition, the manual group was better socially adjusted as measured by an Index of Teacher-Counselor Ratings. The manual group was significantly better on all nine individual social items such as "appropriate sex-role behavior", "maturity", and "friendly". Finally, the manual and oral groups were not significantly different on speechreading and speech, suggesting that manual communication did not impede oral communication skills as had previously been reported.

Stevenson (1964) used a matching procedure to compare the educational achievement of 134 deaf children of deaf parents enrolled in the California School for the Deaf (Berkeley) between 1914 and 1961. He found 90% of the



manual group had attained a higher educational level than deaf children of hearing parents. Of the manual group, 38% went to college compared to only 9% of the oral group.

Quigley and Frasina (1961) compared 16 nonresidential deaf children of deaf parents to 16 nonresidential deaf children of hearing parents and found the manual groups significantly better in vocabulary and equal in speech-reading. Though the manual group had better overall achievement, the proficiency was not significant. The oral group was significantly better in speech.

In an attempt to isolate manual communication as a key factor in the functioning of the deaf, Quigley (1969) compared 16 matched pairs of deaf children, all of whom had hearing parents. The experimental group was given fingerspelling and oral education starting at about age three. The controls had oral education without fingerspelling. He found the fingerspelling group superior in speechreading, written language, and reading skills when tested after entrance to school.

#### Acquisition of Complex Linguistic Ideas

In addition to the specific study of deaf children of deaf parents, Furth (1966) compared deaf and hearing Ss in an attempt to discover more about the deaf person's processes of conceptualization and abstraction. He divided a number of nonverbal tasks into four general divisions:



(a) concept discovery and control; (b) memory and perception; (c) Piaget-type tasks; and (d) logical classification. His basic assumption in such a division was that not all conceptual or abstract thinking required verbal mediation, that is "abstract thinking" can be differentiated from "verbal thinking" by the four classes of tasks he described. All four of these tasks were essentially non-verbal in nature, and on all four the deaf performed as well as the hearing. In some areas, such as Piaget-type tasks (i.e., conservation of mass), young deaf children were inferior to hearing, but the difference disappeared as the child's age increased. Furth cited this particular experiment, and several others in which the deaf were well-acquainted with the concept before testing, as evidence for the hypothesis that the deaf score poorly due to cultural deprivation rather than linguistic deprivation. Furth concluded that since certain deficiencies disappear with an increase in age and since the deaf seem to score poorly on tests where they are not familiar with the general concept, that the deaf "behave as they do, not as a direct or necessary consequence of linguistic deficiency, but as a result of their social environment (p. 151)."

He further supported this hypothesis by comparing the performance of deaf and culturally deprived children on a Piaget-type task. The culturally deprived group's scores fell in between the deaf and control (hearing, culturally

enriched) groups' scores, thus indicating the effect of cultural deprivation on such tasks. He also stated, however, that the deaf children had a difficult time comprehending the concept of amount (i.e., more) in such cases, even when sign language was used. The culturally deprived children were reported to have no trouble with any of the concepts presented during testing.

The problem of the importance of language and knowledge of the concept has been closely studied by Templin (1950). She investigated the abstraction processes in deaf children and found that the deaf were significantly poorer in some abstracting tasks, but not in all. For instance, the deaf were not below the normals on abstract tests that were observable, such as the Kohs Block Test (Kohs, 1923), whereas they were significantly inferior on problems involving the deducing of a principle where not all the cues were observable, as in the Raven's Progressive Matrices (Raven, 1938).

To further investigate the problem of why certain abstracting tasks proved difficult for the deaf, Wright (1955) examined the abstract reasoning ability of deaf and hearing college students. He employed a matching procedure equating intelligence, socioeconomic background, and years in college, and administered the matched groups both verbal and nonverbal tests of abstraction ability. The deaf Ss were inferior on those tests which required

verbal symbols, words, or numbers, but were not inferior on those which used nonverbal stimuli exclusively.

Myklebust (1960) reviewed such findings and reached the conclusion that deafness did not exert a uniform influence on all processes of abstraction. The relationship of deafness to abstraction is closely related to the verbal language limitations imposed by deafness, but it seemed that some types of abstract abilities and conceptual processes were not influenced at all by deafness. A linguistic limitation seemed to be the factor most apparent in all instances of deficiency.

To explore the possibility of a linguistic limitation in deaf SS, a method of testing acquisition of linguistic ideas is required. Since there is currently no standardized test of linguistic abstraction for the deaf, a paradigm designed to investigate the temporal integration and abstraction of linguistic ideas in hearing adults may possibly be adapted for the deaf. One such paradigm which shows promise in this respect is that of Bransford and Franks (1970). These authors were concerned primarily with the integration and memory of information expressed by many different sentences experienced successively, but often not consecutively. (Sentences containing related ideas were never presented consecutively.) Their emphasis was on memory for sets of sentences which expressed common semantic ideas rather than memory for individual sentences

or words. Their studies indicate that adult Ss abstract and store an entire idea, not the individual segments by which the idea was presented. They interpreted their results as indicating that hearing adults may code or construct representations of particular experiences leading to idea or concept construction. Subjects do not do so as a matter of course, but through a system of complex combinations and construction of input.

The work Bransford and Franks did with linguistic inputs stressed that simple sentences contain information which is available and used by Ss to construct wholistic, semantic ideas. These ideas frequently contain more information than is expressed by any single sentence, as the information is combined with information from other sentences. Some process of abstraction or integration of information, experienced successively in time, was postulated.

Their experiments were designed to communicate four separate ideas to all Ss. Each idea could be exhaustively contained in a single complex sentence (e.g., The rock which rolled down the mountain crushed the tiny hut at the edge of the woods.). During the acquisition phase of the experiment, Ss were never presented sentences expressing the complete complex idea, however, but only sentences containing various subsets of the four different semantic properties (e.g., The rock crushed the tiny hut.;

The hut was at the edge of the woods.). Idea acquisition was demonstrated to the extent that this acquisition procedure resulted in Ss acquiring the complete ideas defined by the integration of information contained in related sentences.

A recognition test was administered immediately following the acquisition procedure to test the hypothesis of idea acquisition. Immediately before the recognition task began, Ss were told they would be read a set of sentences which were related to those heard during acquisition. They were told to decide which sentences they had heard during acquisition, which ones they had not heard, and how confident they were about their decisions. They were to indicate this on a confidence rating scale extending from -5 to 5. A score of -5 indicated S was very sure he did not recognize the sentence. A score of 5 indicated S was very sure he had heard the sentence during acquisition. Rankings in between the two extremes indicated varying degrees of confidence of recognition. Recognition sentences included sentences actually heard during acquisition (OLD sentences), sentences not actually heard during acquisition but which were consonant with the ideas previously expressed (NEW sentences), and sentences which were neither heard during acquisition nor consonant with the ideas previously expressed (NONCASE sentences).



Their results demonstrated that NEWS and OLDS were not differentiated by Ss, indicating Ss had acquired the general "idea" rather than making an exact copy of individual sentences. Furthermore, the sentences were ranked in the order of FOURS>THREES>TWOS>ONES>NONCASE. Bransford and Franks interpreted these data as supporting their hypothesis that complex, wholistic, semantic ideas are spontaneously integrated. That Ss were able to differentiate the NONCASE sentences as well, also indicated that there was an abstraction process rather than merely the copying of complex ideas.

O'Malley and Glick (1970) attempted a developmental study using the Bransford and Franks paradigm with children in kindergarten, first, and third grades. They used sentences with the same basic properties as those used by Bransford and Franks, but with words more likely to be within a child's vocabulary (e.g., The pretty girl made a red dress for her doll.). In addition, they employed a less complex rating system of -1, -1, 0, 1, 2 for the recognition portion of their study. The results confirmed the effect Bransford and Franks observed in adults. NEWS and OLDS were not differentiated. Recognition scores were ranked FOURS>THREES>TWOS>ONES>NONCASE. NONCASE sentences were clearly differentiated from permissible sentences. They also found a developmental trend in that the ranking effect as determined by



counting "predictions" from individual data became more pronounced with age, but less than the reported adult level.

### Statement of the Problem

The research reported in the present study is an attempt to isolate factors which may raise the level of academic achievement of deaf children and increase the knowledge concerning the importance of language to such achievement. Two separate studies are presented in order to explore the two areas.

The first study compares the academic achievement of a group of deaf children of deaf parents (manual group) to a group of deaf children of hearing parents (oral group). The former (manual) group had from infancy a systematic method of communication since their parents communicated by signs and fingerspelling. The latter (oral) group had no systematic means of communication until entrance to the deaf school. The manual group, with their earlier use of systematic communication presumably allowing development of conceptual skills, is expected to score higher on achievement tests than the oral group which did not have such advantage. The years from two to five are considered critical in the development of verbally-related intellectual skills since it is at this time that hearing children show the most rapid attainment of language facility.

The second study investigates the problem of abstraction more specifically. Even though this linguistic handicap of deaf children seems to affect some processes of abstraction and conceptualization but not others, the manual group is expected to show more evidence of abstraction of linguistic information than the oral group. Both groups of deaf should be less proficient at abstraction than the hearing group, however, due to the general severity of the handicap of deafness.

Study I: The Effect of Early Manual  
Communication on Achievement in  
Deaf Children

Subjects. The children included in this study were 12 female and eight males who attended the North Carolina School for the Deaf in Morganton. The minimum age for admission to the school is five. All Ss used were age nine or older since this is the minimal age for taking the Stanford Achievement Test. The mean age for the deaf Ss was 14.47 years.

The total enrollment in the school is around 500, and in March, 1971 less than 5% of these had parents who were both deaf. Each deaf child who had deaf parents was matched with a deaf child who had hearing parents on the basis of age, sex, age of onset of deafness, degree of residual hearing, and socioeconomic background. The children of deaf parents had all used manual communication in the home environment before entering the school. Those with hearing parents had no systematic means of communication before coming to the school at age five. This was determined from parental interviews and verified with a questionnaire filled out by the students.

Before matching was begun, the pool of children who had hearing parents was reduced by eliminating those with the possibility of an additional handicap. This procedure was similar to that of Meadow (1968). If the children had

any of the following characteristics, etiologies, or environmental histories they were eliminated from the pool of potential matches:

- (1) Deaf siblings: This is due to socialization problems often occurring in homes with more than one deaf child (Meadow, 1968).
- (2) Secondary handicap (e.g., cerebral palsy).
- (3) Deafness resulting from maternal rubella, Rh incompatibility, or anoxia: These etiologies increase the likelihood of brain damage in addition to deafness.

Deaf children of deaf parents were matched with deaf children of hearing parents of the same age to within six months of birth. All deaf children were deaf before the age of two, and all had a profound hearing loss. Profound hearing loss was defined as a 75 dB hearing loss between 20 and 20,000 Hz. Testing and classification were done at the North Carolina School for the Deaf.

Socioeconomic matching was attempted by pairing children whose parents were engaged in similar occupations, such as manual labor, skilled labor, or sales and clerical work. Matching was not attempted on the basis of IQ scores as had been done in previous research (Meadow, 1968; Stuckless & Birch, 1966). This factor was better controlled by using the intelligence test scores as a covariate in the statistical treatment of the data (Kirk, 1969).

Test Selection and Administration. The Wechsler Intelligence Scale for Children (WISC) (Wechsler, 1949) was chosen for administration for the deaf children due to

the high performance reliabilities, ease of administration, and because the directions for the performance half of the test lend themselves more easily to translation into manual communication. A brief description of the test is reported in Appendix A. Psychologists who have administered the test to children, including deaf children, have commented favorably about the ease of communicating directions of the test as opposed to other intelligence tests for children (Myklebust, 1960).

The Stanford Achievement Test (SAT) was used because of the high degree of correlation it has with the performance half of the WISC (Brill, 1962), because of the high reliabilities of the test itself, and because of the traditional use of the test in the measurement of achievement in deaf children. The batteries of the test are described and the reliabilities reported in Appendix B.

The WISC was administered to all children upon entrance to the school by the school psychologist. The SAT was given by the principals of each school (primary and high school) between March 5 and March 18, 1971. A great deal of training and experience is necessary to administer either IQ or achievement tests to the deaf due to the basic problem of communicating directions and procedures.

Design. A completely randomized analysis of covariance was used to analyze the dependent variable of achievement test grade equivalents for the manual group and

oral group. The covariate was the score on the performance half of the WISC.

Results. The mean grade equivalent scores of the manual group was 4.62 and the mean for the oral groups was 2.86. The mean intelligence test score of the performance half of the WISC was 98.6 for the manual group and 100.9 for the oral. An analysis of covariance of the achievement test scores with intelligence test scores as the covariate is presented in Table 1.

The difference between groups was significant,  $F(1, 17) = 4.66, p < .05$ . Thus, the data apparently support the hypothesis that the manual group show higher achievement test scores, even when these scores are adjusted for IQ scores. The amount of variance accounted for ( $\underline{w}^2$ ) was estimated at 16.2%. This indicates a large amount of the variance in achievement performance is unaccounted for by differences in early communication.



Table 1

Analysis of Covariance of Achievement Test  
Scores of Manual and Oral Groups

Source	<u>df</u>	<u>MS</u>	<u>F</u>
Between groups	1	16.448	4.664*
Within groups	17	3.526	
Total	18		

\*  $p < .05$

Study II: The Acquisition of Complex Linguistic Ideas  
By Deaf and Hearing Children

Subjects. The deaf children used in Study II were 18 of the 20 deaf Ss used in Study I. One deaf child of deaf parents had dropped out of school so neither he nor the deaf child of hearing parents he was paired with was used. Nine remaining pairs were matched on the basis of age and sex with nine hearing children of hearing parents. The age range of the group was from 8.75 to 17.10 years. The mean age of the deaf children was 14.03 and the mean age of the hearing children was 14.11 years.

Materials. The materials consisted of a set of English sentences constructed in the following manner: (a) four complex sentences were constructed, each of which exhaustively represented the semantic information in one of four ideas to be acquired; (b) each complex sentence (complete idea) was constructed to represent the relations among four simple declarative sentences; (c) each of the four complex sentences was broken down into its four simple declaratives. These simple sentences containing one idea were called ONES. When a sentence contained two or three of the simple ideas it was classified as either a TWO or a THREE respectively. The complex sentences containing all four ideas were called FOURS. The four complex sentences that were used were:

A. The white kitten running from the spotted dog

climbed a tree.

- B. The boy who lived next door broke a big window on the porch.
- C. The old car pulling the trailer climbed the steep hill.
- D. The pretty girl made a red dress for her doll.

During the acquisition phase of the experiment, Ss were read six sentences from each set: two THREES, two TWOS, and two ONES. Acquisition sentences were chosen such that together they exhausted the semantic propositions in each complex idea. Those sentences used during acquisition are identified in Appendix C (e.g., A-5).

During the recognition phase of the experiment, the remaining sentences were read: one FOUR, one THREE, two TWOS, and two ONES. Six "OLD" (acquisition) sentences and six "NONCASE" sentences (sentences combined across ideas) were also included among the 36 recognition sentences. The recognition sentences are also denoted in Appendix C (e.g., R-14).

Procedure. The experiment was performed separately on deaf and hearing children so that they would be near their normal living environment. One group of deaf children (five deaf of deaf, four deaf of hearing) received the acquisition sentences in the order of one to 24, the other (four deaf of deaf, five deaf of hearing) in the order of 24 to one. One half of the hearing group received the sentences in the order of one to 24, the other one half

received the sentences in the order of 24 to one.

During acquisition, Ss were told that their task would be to answer questions about sentences which would be shown to them immediately after each sentence. The sentences were then presented one at a time for seven seconds by means of an opaque projector. All Ss were then presented an elliptical question concerning the sentence just shown. The answer to the question was given in writing by Ss. This procedure was followed until all 24 of the acquisition sentences had been presented.

Examples of possible elliptical questions were: Where?; What color?; and Did what?. Only one question was asked at each presentation of an individual sentence. Questions were designed so that each constituent of each idea was questioned about as often as each other constituent.

The acquisition list consisted of 24 sentences, six from each of the four different idea sets. The acquisition sentences from each set consisted of two ONES, two TWOS, and two THREES. Acquisition sentences were chosen so that, as a group they exhausted the information characteristic of each idea.

The order of presentation of the 24 acquisition sentences was arranged so that in each successive sequence of four sentences there was one sentence from each of the different idea sets. Sentences were randomized within each

block of four sentences with the constraint that no two sentences from the same idea set occurred consecutively on the list. The ONES, TWOS, and THREES from each idea set were randomly distributed across the full acquisition list. During acquisition Ss were not told there would be a second part to the experiment (i.e., recognition).

Following acquisition, Ss were given a five minute break. They were then told that they would now be shown a new set of sentences, all of which were closely related to the set of sentences they had just seen. Their task was to indicate which of the sentences in the new set they had actually seen before and which they had not. A five-point confidence rating scale which ranged from -2 to +2 was provided. If S were sure he had not heard the sentence, he was to mark -2. If he thought he had not heard the sentence, but was not sure, he was to mark -1. If he were sure he had heard the sentence before he was to mark +2. If he thought he had heard the sentence, he was to mark +1. The 0 rating was to be marked if no decision could be made as to whether or not the sentence had been heard. To make explanation easier, faces were drawn above each of the stimuli used by Ss. Faces with frowns represented the negative rankings, those with smiles represented positive rankings. The scale is presented in Appendix D. Before beginning the recognition phase, the rating scale was explained to the whole group, and the question was asked,



"What would you mark if you were very sure you had heard the sentence before?" All Ss were also asked the question, "What would you mark if you were very sure you had not heard the sentence before?" When all Ss demonstrated correct usage of the scale, the recognition phase of the experiment was begun. After the presentation of each recognition sentence, S made a recognition judgment using the confidence rating scale.

The recognition list consisted of 36 sentences. Of these, 30 were from the original four idea sets. Twenty-four of these sentences were NEW sentences, i.e., they had not been presented in acquisition. There were six of these sentences from each of the four idea sets. Each of these groups of six sentences contained two ONES, two TWOS, one THREE, and one FOUR (the only FOUR).

In addition to the 24 NEW sentences, six sentences from the acquisition list were included in the recognition list (OLD sentences). These included two ONES, two TWOS, and two THREES chosen to fairly represent the four idea sets. There were also six NONCASE sentences in the recognition list. These contained information present in the four idea sets, but their composition violated relationships represented in the ideas to be learned. One NONCASE sentence had the same units as one of the FOURS, but the relationship of the units was changed (e.g., The white kitten was running from the spotted dog which climbed the



tree.). Five NONCASE sentences contained intruding concepts (e.g., The white kitten running from the spotted dog climbed a hill.; The pretty girl running from the big dog climbed on the porch.; The red car pulling the trailer crashed into a tree on the hill.; The pretty girl who lives next door made a red dress.; The white car parked next door climbed the big hill.).

Again the list was constrained so that no two sentences from the same idea set were consecutive. There was one NONCASE and one OLD, as well as four NEW sentences representing different ideas within the six sets of six sentences. ONES, TWOS, THREES, and FOURS were randomly distributed throughout the list.

Design. Mean recognition rating scores for the NEW sentence categories of ONES, TWOS, THREES, and FOURS (within-S variable) were entered in a split plot analysis of variance for the oral, manual, and hearing groups (between-group variable). In addition, OLDS and NEWS for each individual group were compared by means of a t test on the recognition scores of each group. Finally, three separate t tests were used to determine if there was a difference between the lowest permissible sentences (ONES) and NONCASE sentences for any of the groups.

Results. Figure 1 depicts the mean confidence ratings of new sentences for each sentence category for the three groups. Evidence for demonstration of an effect

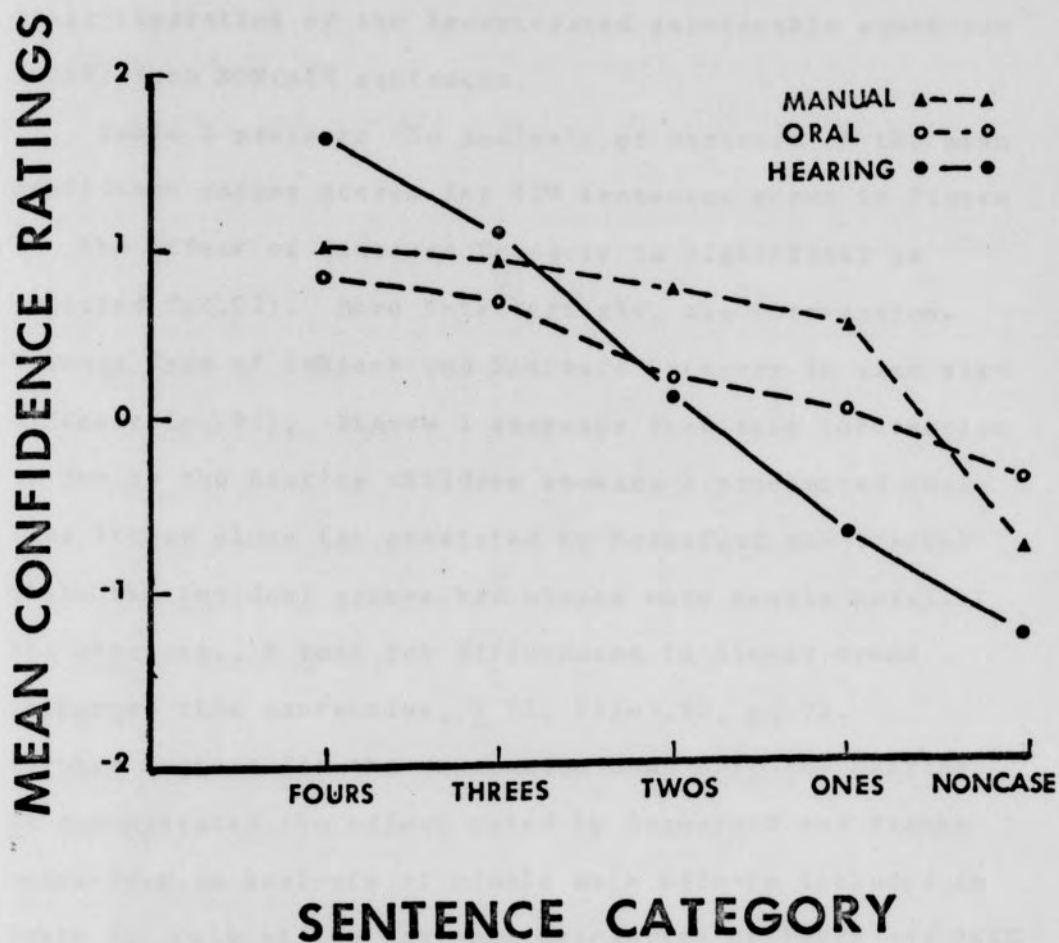


Fig. 1. Mean Confidence Ratings for Recognition as a Function of Sentence Category (NEW Sentences Only).

similar to that of Bransford and Franks is a negative linear slope of the line for FOURS through ONES with a clear separation of the lowest-rated permissible sentences (ONES) from NONCASE sentences.

Table 2 presents the analysis of variance of the mean confidence rating scores for NEW sentences shown in Figure 1. The effect of Sentence Category is significant as expected ( $p < .01$ ). More interestingly, the interaction between Type of Subject and Sentence Category is also significant ( $p < .01$ ). Figure 1 suggests that this interaction is due to the hearing children showing a pronounced negative linear slope (as predicted by Bransford and Franks) while the two deaf groups had slopes more nearly parallel the abscissa. A test for differences in linear trend supported this contention,  $F(2, 24) = 3.80, p < .05$ . Further support for the contention that only the hearing Ss demonstrated the effect noted by Bransford and Franks comes from an analysis of simple main effects included in Table 2. Only at the sentence categories of FOURS and ONES did the groups differ as predicted. In addition only the hearing group showed a significant difference across sentence categories.

Further evidence of abstraction should be found in the ratings for OLDS and NEWS. Bransford and Franks make the claim that if some process of abstraction has taken place rather than a simple copy process, the NEWS should

Table 2  
Analysis of Variance of Confidence Ratings of Manual,  
Oral, and Hearing Children for NEW Sentences

Source	<u>df</u>	<u>MS</u>	<u>F</u>
Between Subjects	26	1.488	
Type of Subject (TS)	2	.985	.63
Between TS at 4's	2	1.570	8.63*
Between TS at 3's	2	.300	1.65
Between TS at 2's	2	.125	.69
Between TS at 1's	2	6.750	37.09*
Within Cell	96	.182	
Within Subjects	81	.994	1.40
Sentence Category (SC)	3	9.540	18.91*
Between SC at Manual	3	.560	1.40
Between SC at Oral	3	1.380	2.73
Between SC at Hearing	3	13.770	25.29*
AB	6	2.920	5.78*
B x Subj. w/groups	72	.505	
Total	108		

\* $p < .01$

receive about the same mean recognition scores as the OLDS of the same sentence complexity. The curves in Figure 2 present the mean confidence ratings for OLDS and NEWS for all three groups individually. A t test done for each group showed that there was no significant difference between OLDS and NEWS for manual, t (8)=0.39,  $p>.25$ ; oral, t (8)=0.40,  $p>.25$ ; or hearing groups, t (8)=1.34,  $p>.10$ .

The Bransford and Franks memory model also states that strong evidence for demonstrating abstraction of linguistic ideas is the differentiation of NONCASE from the lowest permissible sentences (ONES) since NONCASE sentences clearly violate the ideas which have been abstracted. Both the hearing t (8)=4.29,  $p<.01$ , and the manual groups, t (8)=2.07,  $p<.05$ , were able to separate ONES from NONCASE sentences. There was no significant difference for the ONES and NONCASE sentences for the oral group, t (8)=1.59,  $p>.05$ .

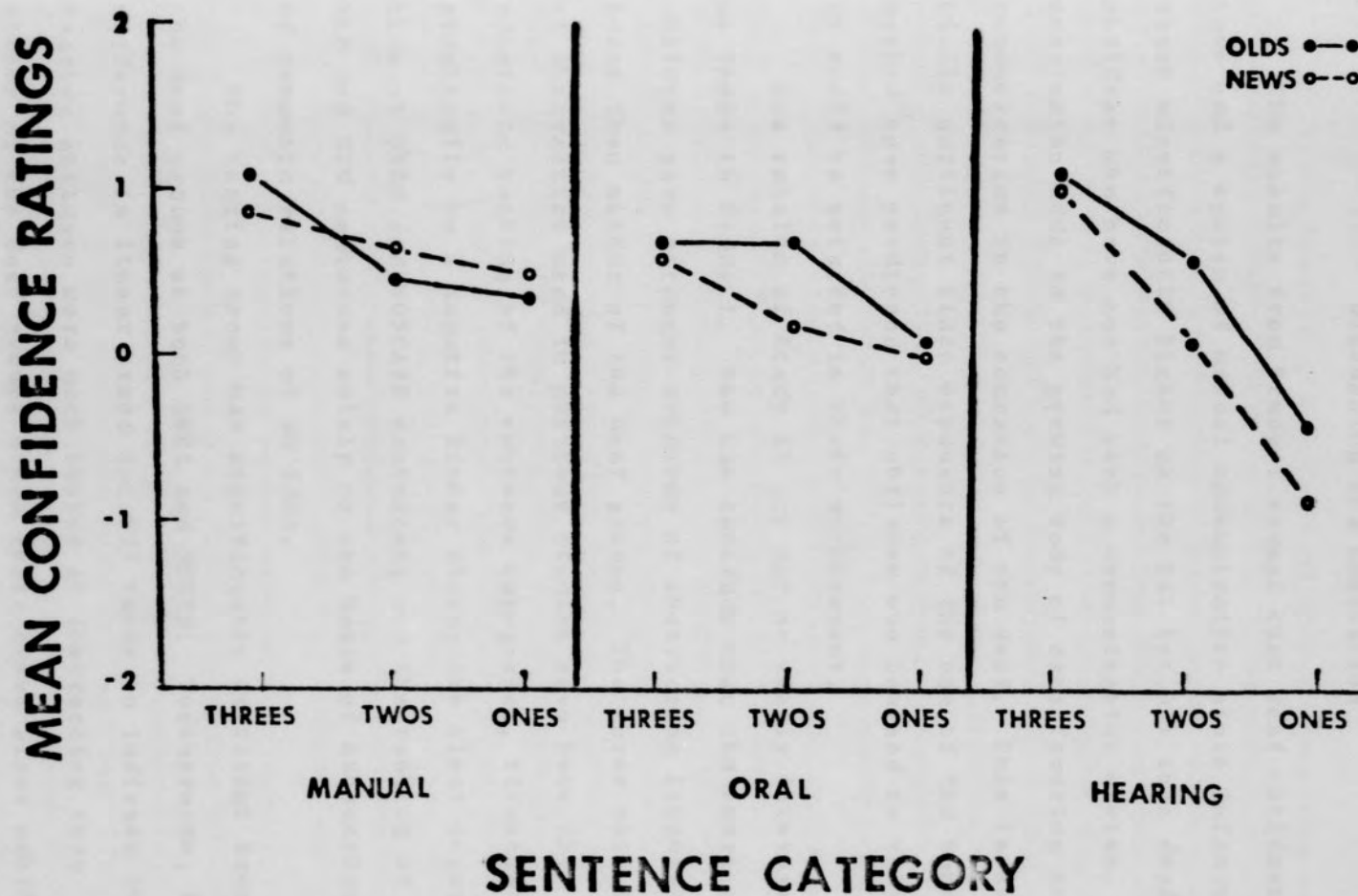


Fig. 2. Mean Confidence Ratings for OLD and NEW Sentences for Manual, Oral, and Hearing Groups.



### Discussion and Conclusion

The results from Study I reveal that deaf children who have had a system of manual communication since infancy score significantly higher on the SAT ( $p < .05$ ) than deaf children who have not had such a communication system. This conclusion adds to the growing body of data favoring manual communication in the education of the deaf. This is especially pertinent since opponents of the use of the manual method have predicted that children who learned to rely on it would be retarded in their achievement.

The results of Study II are not so easily interpreted as those in Study I. One can conclude that the hearing children gave stronger evidence of abstracting linguistic ideas than either of the deaf groups. The three criteria of abstraction used in previous studies have been the monotonic ranking of the sentence categories, illustrated graphically by a negative linear slope; the clear separation of ONES and NONCASE sentences; and the ranking of both OLD and NEW sentences solely on the basis of exhaustion of semantic relations of an idea.

The hearing group was significantly different from the deaf groups at both ONES and FOURS. Furthermore, the difference in linear trend ( $p < .05$ ) tends to indicate the hearing children were much better at abstracting than either of the deaf groups since their curve alone exhibited

a nonzero slope.

Both the hearing and the manual groups were able to differentiate between ONES and NONCASE sentences. Since NONCASES are sentences which are semantically complex, but which violate the relationships of the ideas that are presumably acquired, the ability to distinguish these from the ideas actually presented during acquisition would indicate that ranking did not occur solely on the basis of complexity. In fact, the least complex ideas acquired (ONES) were differentiated from the NONCASE by both groups, indicating that sentences are filtered first on the basis of their meaning and then on degree to which a sentence exhausts all the semantic relations characteristic of a complete idea.

Since all three groups were unable to differentiate between OLD and NEW sentences, this may mean that neither deaf nor hearing children make specific copies of the sentences as presented, but rather retain the ideas presented in the sentences. This retention is indicated by the lack of differentiation between sentences seen in acquisition and novel sentences presented only in recognition. This particular result seems to extend the notion of the abilities of the deaf beyond that of rote memorization. Although they do not obtain the more complex ideas (FOURS) as well as the hearing children, as shown by the curves in Figure 1, they apparently do more than simply memorize

sentence input.

Thus the test of abstraction of linguistic ideas, although general in its approach to problems encountered in the education of the deaf, may have certain significance. The trend which favors memorization of vocabulary and grammatical rules in the education of the deaf could possibly be broadened. Deaf children do show some ability to abstract ideas, the manual group especially in that they were able to perform similarly to the hearing on two of the three criteria.

Since society demands that a deaf person possess speech and speechreading to be employed or socially acceptable, it would follow that the deaf must learn an oral system at some time in their educational history. An important point is that few deaf individuals master such a system even after a long history of training. An alternative solution is to use manual communication, a system of education consisting of both signs and finger-spelling, as a supplementary language, but one taught before entry into the formal system of education. When employed at an early age, manual communication would enable the child to interact and react more effectively with his environment. The fact that deaf children can learn manual communication without formal instruction indicates the possibility of early effective use of a manual language system.

The evaluation of the effects of such a system is a tremendous obstacle confronting officials in those schools which seek to implement it. At the present time, there are few tests of infant intelligence and even fewer standardized on handicapped infants. One possible exception comes from investigations by Hunt and Uzgiris at the University of Illinois (Hunt & Uzgiris, 1964). They have begun standardizing an ordinal test of intelligence that requires few verbal responses or directions in the early years. This limited use of verbal instructions and responses means that such a test may be adaptable for use with deaf infants. The use of such a measure would allow programs of manual and combined techniques of instruction to be evaluated through longitudinal studies. In addition, comparisons could be made with hearing infants to more accurately determine deviations in performance and locate ages of such deviation during their development. The Hunt-Uzgiris scale has six subscales of development which would allow the assessment of different profiles as a function of varying kinds of contact with the environment.

Urgently needed though, is the continued development of these scales past the sensorimotor period (roughly the first two years) from two to 12, especially the years from two to five where the child acquires verbal facility. Since the Piaget theory stresses continuity between the preverbal and verbal thought processes (Hunt, 1961), an

intelligence test based upon it should have no discontinuity in its validity. Such a quality in a test would make it most appropriate for assessing the growth of symbolic processes during these early years. Ideally the test would be extended into the formal operations period where Piaget says true abstracting begins, usually early adolescence. Perhaps the demonstration of the kind of abstracting of linguistic ideas that Bransford and Franks have demonstrated can be quantified on such an ordinal scale of intelligence. If such abstraction were to qualify as a behavioral landmark, then it would gain perspective against other intellectual abilities and the results of Study II would be more understandable.



## References

- Beach, J. E. A study of the relationship of intelligence and academic achievement of a selected group of deaf pupils. Unpublished master's thesis, Mississippi State College, 1970.
- Bransford, J. D. & Franks, J. J. The abstraction of linguistic ideas. Unpublished manuscript, University of Minnesota, 1970.
- Brill, R. The relationship of Wechsler IQ's to academic achievement among deaf students. Exceptional Children, 1962, 28, 315-322.
- Brown, A. W., Stein, A. P., & Rohrer, P. L. The Chicago Non-Verbal Examination, Manual of Directions. New York: Psychological Corporation, 1947.
- Craig, W. M. Effects of preschool training on the development of reading and lipreading skills of deaf children. American Annals of the Deaf, 1964, 103, 280-294.
- Drever, J. & Collins, M. Performance tests of intelligence. London: Oliver and Boyd, 1936. Cited by H. R. Myklebust, The psychology of deafness. New York: Columbia University Press, 1960, p. 64.
- Furth, H. G. Thinking without language. The Free Press, 1966.
- Hiskey, M. S. Nebraska Test of Learning Aptitude for Young Deaf Children. Lincoln: University of Nebraska, 1955.
- Hunt, J. McV. Intelligence and experience. New York: Ronald Press, 1961.
- Hunt, J. McV. & Uzgiris, I. C. A scale of infant psychological development. Unpublished manuscript, University of Illinois, 1964.



- Kirk, R. E. Experimental design: procedures for the behavioral sciences. Belmont: Brooks/Cole, 1969.
- Kohs, S. C. The Block Design Test, Chicago: C. H. Stoelting, 1923.
- Leiter, R. G. The Leiter International Performance Scale. Santa Barbara: State College Press, 1940.
- O'Malley, A. K. & Glick, J. A. A developmental study of the acquisition of complex linguistic ideas. Unpublished manuscript. University of Minnesota, 1970.
- McAndrews, H. Rigidity and isolation; a study of the deaf and the blind. Journal of Abnormal and Social Psychology, 1948 43, 476. Cited by H. R. Myklebust, The psychology of deafness. New York: Columbia University Press, 1960, p.86.
- McClure, W. J. Current problems and trends in the education of the deaf. Deaf American, 1966, 18, 8-14.
- Meadow, K. P. The effect of early manual communication in relation to the deaf child's intellectual, social, and communicative functioning. American Annals of the Deaf, 1968, 113, 29-42.
- Moore, D. F. Psycholinguistics and deafness. American Annals of the Deaf, 1970, 115, 37-48.
- Myklebust, H. R. Towards a new understanding of the deaf child. American Annals of the Deaf, 1953, 98, 345-357.
- Myklebust, H. R. The psychology of deafness. New York: Columbia University Press, 1940.
- Phillips, W. D. Influence of preschool training on achievement in language arts, arithmetic concepts, and socialization of young deaf children. Unpublished doctoral dissertation, Columbia Teachers College, 1963. Cited by M. Vernon, Sociological and psychological factors associated with hearing loss. Journal of speech and hearing research, 1969, 12, p. 545.
- Pinter, R. A mental and educational survey of schools for the deaf. American Annals of the Deaf, 1920, 65, 451-457.

- Quigley, S. P. The influence of fingerspelling on the development of language, communication, and educational achievement in deaf children. Urbana: University of Illinois, 1969.
- Quigley, S. P. & Frasina, D. Institutionalization and psychoeducational development of deaf children. Council of Exceptional Children Research Monograph, 1961, (Series A, No. 3).
- Raven, J. C. Guide to Standard Progressive Matrices. London: H. K. Lewis, 1960.
- Schein, J. D. & Bushrag, S. Higher education for the deaf in the United States--a retrospective investigation. American Annals of the Deaf, 1962, 107, 416-461.
- Stevenson, E. A. A study of the educational achievement of deaf children of deaf parents. Berkeley: California School for the Deaf, 1964.
- Stuckless, E. R. & Birch, J. W. The influence of early manual communication on the linguistic development of deaf children. American Annals of the Deaf, 1966, 111, 452-462.
- Templin, M. C. The development of reasoning in children with normal and defective hearing. Minneapolis: University of Minnesota Press, 1950.
- Vernon, M. Sociological and psychological factors associated with hearing loss. Journal of Speech and Hearing Research, 1969, 12, 541-563.
- Vernon, M. & Brown, D. W. A guide to psychological tests and testing procedures in the evaluation of deaf and hard-of-hearing children. Journal of Speech and Hearing Research, 1964, 29, 414-423.
- Wechsler, D. Wechsler Intelligence Scale for Children. New York: Psychological Corporation, 1949.
- Wright, R. The abstract reasoning of deaf college students. Unpublished doctoral dissertation, Northwestern University, 1965. Cited by H. R. Myklebust, The psychology of deafness. New York: Columbia University Press, 1960, p. 88.

Wrightstone, J. W., Aronow, M. S., & Moskowitz, S. Development reading test norms for the deaf child. American Annals of the Deaf, 1962, 108, 311-316.

Zeckle, A. & Van der Kolk, J. J. A comparative intelligence test of groups of children born deaf and of good hearing by means of the Porteus Maze Test. American Annals of the Deaf, 1939, 114, 84-88.

## Appendix A

### Description of the Wechsler Intelligence Scale for Children

The Wechsler Intelligence Scale for Children was developed and published by David Wechsler in 1949 (Wechsler, 1949), and was designed specifically for children age five through 15.

The test consists of five verbal and five performance subtests. The verbal half consists of General Information, General Comprehension, Arithmetic, Similarities, and Vocabulary. The performance half includes Picture Completion, Picture Arrangement, Block Design, Object Assembly, and Coding.

The WISC was standardized on a sample of 100 boys and 100 girls at each age from five through 15 years. Each child was tested within one and one-half months of mid-year. There were 1100 boys and 1100 girls in the original sample of 2200 children tested. Samples were chosen to represent all geographic areas, urban and rural proportions, and parent occupations.

Because no alternate form of the test was available, and since the test is considered a power test, split-half reliabilities at ages 7.5, 10.5, and 13.5 were used. Verbal reliabilities were .88, .96, and .96 at these ages. Performance reliabilities were reported to be .86, .89, and .90. Full Scale reliabilities were .92, .95, and .94.

## Appendix B

## Description of the Stanford Achievement Test

The Stanford Achievement Test was published in 1923. The 1964 edition, authored by Richard Madden, Eric F. Gardener, Herbert C. Rudman, and Truman Kelly, was administered to children in this study. All five batteries of the test were used due to the wide range of ages. These included Form W of Primary I, Primary II, Intermediate I, Intermediate II, and Advanced Batteries.

The 1964 edition of the Stanford Achievement Test is the fourth extensive revision of the test, and is the product of five years research designed to provide a comprehensive test series for grades one through nine. The reasons for using the test in many schools include convenience to administer, interpret, and score, the up-to-date norms, and the history of use at schools.

For all batteries, the Grade equivalents are conveniently found in each test for conversion of the raw score. Percentile ranks, stanines, and profile charts are also provided. Split-half reliability coefficients corrected by the Spearman-Brown formula are based on 1000 cases drawn from 76 school systems representative of national standardization. The average reliabilities range from .66 for the test for science and social studies at grade two, to .95 for Arithmetic in grade level one. The average over all tests is reported to be .88.



## Appendix C

## Acquisition and Recognition Sentences

## Sentence Set A

## FOUR

The white kitten running from the spotted dog climbed a tree. (R-2)

## THREES

The kitten running from the spotted dog climbed a tree. (A-5)

The white kitten running from the dog climbed a tree. (A-2)

The white kitten was running from the spotted dog. (R-10)

## TWOS

The kitten running from the dog climbed a tree. (R-34)

The white kitten climbed a tree. (A-19)

The kitten was running from the spotted dog. (A-14)

The white kitten was running from the dog. (R-14)

## ONES

The kitten was white. (A-10)

The kitten was running from the dog. (R-19)

The dog was spotted. (A-21)

The kitten climbed a tree. (R-25)

## Sentence Set B

## FOUR

The boy who lived next door broke a big window on the porch. (R-30)

## THREES

The boy who lives next door broke a big window. (R-3)

The boy who lives next door broke a window on the porch. (A-23)



## Appendix C (continued)

The boy broke a big window on the porch. (A-20)

## TWOS

The boy broke a big window. (R-8)

The boy broke a window on the porch. (R-24)

The big window was on the porch. (A-7)

The boy who lives next door broke a window. (A-23)

## ONES

The boy broke a window. (R-13)

The window was on the porch. (R-33)

The window was big. (A-4)

The boy lives next door. (A-12)

## Sentence Set C

## FOUR

The old car pulling the trailer climbed the steep hill.  
(R-27)

## THREES

The old car pulling the trailer climbed the hill. (R-15)

The old car climbed the steep hill. (A-17)

The car pulling the trailer climbed the steep hill. (A-24)

## TWOS

The car pulling the trailer climbed the hill. (R-11)

The old car climbed the hill. (R-35)

The car climbed the steep hill. (A-15)

The old car was pulling the trailer. (A-1)

## ONES

The hill was steep. (R-23)

## Appendix C (continued)

The car climbed the hill. (R-4)

The car was old. (A-13)

The car was pulling the trailer. (A-6)

## Sentence Set D

## FOUR

The pretty girl made a red dress for her doll. (R-16)

## THREES

The girl made a red dress for her doll. (R-21)

The pretty girl made a dress for her doll. (A-16)

The pretty girl made a red dress. (A-22)

## TWOS

The pretty girl made a dress. (R-9)

The girl made a red dress. (R-36)

The red dress was for her doll. (A-18)

The girl made a dress for her doll. (A-8)

## ONES

The dress was for her doll. (R-5)

The girl made a dress. (R-28)

The dress was red. (A-11)

The girl was pretty. (A-3)

## NONCASE Sentences

The white kitten was running from the spotted dog which  
climbed a tree. (R-22)

The white kitten running from the spotted dog climbed a  
hill. (R-6)

## Appendix C (continued)

The pretty girl running from the big dog climbed on the porch. (R-12)

The red car pulling the trailer crashed into a tree on the hill. (R-18)

The pretty girl who lives next door made a red dress. (R-26)

The white car parked next door climbed the big hill. (R-32)

Appendix D  
Confidence Rating Scale

